yet arrived at the first stage of improvement—the knowledge of their own ignorance."

Among the glowing tributes to Gladstone's memory which have been offered since his death, none are more significant than the following words from one who is singularly well qualified to form an opinion as to the value of his educational work. "It is twenty years," the writer says, "since I first made his acquaintance as a co-worker on my election to the London School Board, and the respect which I felt at first for his activity and devotion in the cause of London education soon ripened into a real personal affection and warm admiration for his unselfish and kindly nature and for his insight into the needs of children intended for industrial life. He was almost the first to see that elementary education must be widened to include the training of all the faculties if it is to be effective, and he did more than any to bring this knowledge to a practical result. It would be well for the country if more men existed of the same noble character."

He has left many witnesses to his power of influencing young scientific workers, to many of whom his memory will be very precious, for but few men have been so faithful throughout a long life to high ideals, and have at the same time so effectively promoted the welfare of humanity. W. C. R. A.

NOTES.

THE subject of the address of the retiring president (Dr. E. W. Hobson, F.R.S.) of the London Mathematical Society at the annual general meeting on Thursday, November 13, at 5.30, will be "The Infinite and the Infinitesimal in Mathematical Analysis." There are few people better qualified than Dr. Hobson, both on the mathematical and the philosophical side, to expound the change of view that has been gradually spreading over the field of advanced pure mathematical thought during the last half-century; and many persons interested in the subject will doubtless take advantage of his explanations who would not have time to make headway with the extensive literature, mainly foreign, to which these modern philosophical developments have given rise. At the same meeting, the triennial De Morgan medal will be presented to Prof. A. G. Greenhill, F.R.S., for his contributions to mathematical analysis and its application to mechanical problems.

WHILE attempting to navigate the air with a new steerable balloon, M. de Bradsky and his assistant, M. Morin, were killed at Stains, near Paris, on October 13. The balloon was so constructed that the weight of the gas and all its parts was about equal to the weight of air displaced, so that it remained at rest until the propelling screw was started. The screw was driven by a 16 horse-power motor and was behind a steel car, seventeen metres long, suspended by steel wires attached to a light wooden scaffolding. After the balloon had started, it was evident to the spectators that the motor power was insufficient to enable it to be steered. When at an altitude of about one hundred metres, the car broke away from the balloon and was dashed to the ground, causing the death of the two occupants—M. de Bradsky and M. Morin. The disaster appears to have been caused either by the fracture of the steel wires by which the car was suspended from the envelope, or by the whole framework slipping away from the balloon.

ON Friday, November 7, Lord Kelvin will reopen the ancient Cloth-hall at Newbury, which has been restored as a memorial to Queen Victoria and will in future be utilised as a local museum and art gallery.

THE committee of the Huxley Memorial at Ealing has had a memorial tablet placed in the Free Library, Walpole Park, and it will be unveiled by the Mayor of Ealing, on behalf of the Borough Council, on October 23 at 4 p.m.

THE annual "Fungus Foray" of the Essex Field Club will be held on Friday and Saturday, October 17 and 18—in the country near North Weald and Foot Hill on the Friday, and on the Saturday in Epping Forest. Botanists desirous of attending should communicate with the hon. secretary, Mr. W. Cole, Buckhurst Hill, Essex.

WE learn from the *Times* that an interesting antiquarian discovery has just been made in the neighbourhood of High Wycombe in connection with the construction of the new main line of the Great Western and Great Central Railway Companies. In the course of excavating a hill an ancient flint mine has been unearthed, together with an interesting specimen of a pick made of the antler of a stag with its points worn smooth. Many of the disintegrated blocks bear the marks made by the picks used by prehistoric workmen.

THE council of the Institution of Civil Engineers has, in addition to the medals and prizes given for communications discussed at the meetings of the Institution in the last session, made the following awards in respect of other papers dealt with in 1901–1902:—A Telford gold medal to Mr. J. Macfarlane Gray; a George Stephenson gold medal to Mr. R. Price-Williams; a Watt gold medal to Dr. W. Bell Dawson; Telford premiums to Mr. W. R. Cooper, Mr. E. M. De Burgh, Dr. George Wilson, Mr. Frank Oswell and Dr. A. W. Brightmore; a Crampton prize to Mr. C. D. H. Braine; the Manby premium to Mr. B. W. Ritso. For students' papers the awards are:—A Miller scholarship (tenable for three years) and the James Forrest medal to Mr. H. F. Lloyd; Miller prizes to Messrs. J. C. Collett, W. H. C. Clay, H. C. M. Austen, A. M. Arter, Robert Bruce, L. F. Wells and W. H. McLean.

PROF. ROBERT WALLACE is preparing for publication the "Reminiscences" of the late Miss E. A. Ormerod, to the preparation of which she devoted the leisure of her later days. The autobiography was not completed, and much additional material of an interesting character must be in existence. Prof. Wallace would be glad to receive such letters from Miss Ormerod as her correspondents may consider of sufficient importance, together with any other information which they think will be of interest to the general public. His address is the University Edinburgh.

THE remarkable successes achieved by the Marconi system in transmitting messages from Cornwall, across the continent, to the *Carlo Alberto*, moored off the coast of Italy, are well known; some further details of the experiments were published in the *Times* of October 14, from the official report upon them. It appears from this report that the magnetic detector, recently described by Mr. Marconi before the Royal Society, proved in every way superior to the coherer. It was much more accurate in its working and required no regulation. Moreover, it was less sensitive to atmospheric disturbances, giving fairly clear signals under conditions which put the coherer *hors de combat*. The experience on board the *Carlo Alberto* also served to confirm the observation that signalling was more difficult during the day than the night, but this only necessitates increasing the power at the transmitting station in order to carry on long-distance work continuously; there seems to be a practical limit to the sensitiveness of the receiver in that it must not be made too easily affected by atmospheric influences.

THE subject of this year's essay competition for the prizes of 10*l.* and 5*l.* annually offered by the Society for the Protection of Birds (3 Hanover Square, W.) is "Birds in the Field and Garden: their Economic Value to Man." The Society's object is to collect facts and opinions respecting the utility of birds as insect and weed destroyers, a matter which has in recent years compelled attention in various parts of the world, but is still only very imperfectly understood and appreciated. Full particulars may be obtained from the hon. secretary.

THE Huxley memorial lecture was delivered on October 1 at the opening of the Charing Cross Hospital Medical School by Prof. Welch, of the Johns Hopkins University, whose discourse was entitled "Recent Studies of Immunity with Special Reference to their Bearing on Pathology." After a tribute to the memory of Huxley and of Virchow, Prof. Welch proceeded to discuss the specific properties of the cells and fluids of the body in health and disease in their relation to immunity, referring to the various antitoxic, bacteriolytic, hæmolytic and cytolytic functions exerted under certain conditions. He pointed out that whereas the tetanus and diphtheria bacilli elaborate toxins which can be separated from the organisms that produce them, such is not the case with other pathogenic bacteria, notably the typhoid bacillus, the toxin of which is believed to be intracellular and intimately associated with the bacterial cells. On this conception, the disease symptoms present in typhoid fever are assumed to be due, not to the living and vigorous organisms, but to typhoid bacilli which have died and in consequence have set free their protoplasmic poisons. Prof. Welch doubts whether this theory affords a complete explanation of the toxic phenomena in typhoid and other similar infections, and advances an ingenious alternative hypothesis. The injection of bacterial cells stimulates certain cells of the host to generate one component of the toxin, the intermediary body, which although itself not poisonous, becomes so by bringing about the union between a pre-existing toxophorous substance, the complement and the foreign cell which started the reaction. Similarly, Prof. Welch suggests that certain substances derived from the host may stimulate the invading organism and cause it to produce intermediary bodies which might have the power to link complements to cellular constituents of the host and thereby to poison the latter. That is to say, just as the cells of the organism react towards the invading bacterium, so Prof. Welch suggests does the bacterium react towards the cells of the host, a possible factor hitherto overlooked. Finally, it was pointed out that such researches as these can be carried out only by the experimental method, and that to impose unnecessary restrictions with regard to experiments upon animals is nothing short of a crusade against humanity.

WE have received a valuable series of meteorological results made at Truro for the Royal Institution of that town. The tables are divided into two sets, (1) the monthly values for the separate years 1882–1900, and (2) the average monthly values for fifty-one years, 1850-1900, compiled by Mr. G. Penrose, curator of the Truro Museum. The establishment of the observatory was mainly due to the late Dr. Barham, who prepared the summary for the years 1850–1881. The mean of the daily maximum temperature is 58°·5 and of the daily minimum 44°·7, the extremes being 92° in June, 1893, and 8° in January, 1867. The mean annual rainfall is high, 40·5 inches. It is noteworthy that the Cornwall Institution possesses several long series of observations, dating from those of Dr. Borlase, of Ludgvan, 1754–1772; Mr. James, at Redruth, 1787–1806; Mr. E. C. Giddy, at Penzance, 1807–1827. These are closely followed by Mr. Moyle's, at Helston, and others.

A REDETERMINATION of the density and coefficient of cubical expansion of ice at 0° C. is given by Mr. J. H. Vincent in the *Physical Review*. The author, after comparing previous results, obtains a value agreeing closely with that found by Nichols for the density, but considers that the coefficient of cubical expansion is from 4 to 5 per cent. less than the mean of the previous determinations.

MR. S. J. BARNETT contributes to the *Physical Review* a note on Gauss's theorem, considered mainly with respect to electrostatics. It is pointed out that the ordinary demonstrations apply only to the case of a single homogeneous isotropic medium, and that the theorem is usually implicitly assumed to hold good in all cases. Mr. Barnett now attempts to deduce the generality of the theorem in a logical manner. But in order to extend the validity to a region containing any number of homogeneous dielectrics, or to a medium of varying permittivity, the author has to assume that in a condenser containing two dielectrics, one in contact with one face and the other in contact with the other, the charges on the two faces are equal and opposite. The theorem is thus seen to be based on experimental evidence and not to be capable of proof by deductive methods alone.

FROM the Report of the Survey of India for 1900–1, we notice that surveyors were engaged during the season in the determination of astronomical latitudes in Karachi, while another party was employed with satisfactory results on experimental work connected with the Jaderin base line apparatus. Tidal observations were continued as usual. Preparations for the commencement of a magnetic survey were continued during the year, and arrangements were made for the establishment of base stations at Bombay, Kodaikanal, Dehra Dun, Calcutta and Rangoon, at which magnetic observatories are to be built and self-recording instruments installed. The recent introduction of electric tramways in Calcutta and their impending construction in Bombay have rendered it necessary to arrange for the construction of the new observatories far enough away from the two cities to be beyond the effects of the electric current.

THE Bremer arc lamp, in which the arc is maintained between a pair of inclined carbons saturated with certain mineral salts (see NATURE, this volume, p. 272), has recently been subjected to careful photometric tests by two independent observers, M. Laporte in Paris and Prof. Wedding in Charlottenburg. A full discussion of the two sets of experiments is given in *L'Éclairage Électrique* for October 4. The results are not in very close agreement, though both bring out the superiority of the Bremer lamp over ordinary arc lamps. This is especially noticeable if one only considers the mean hemispherical candle power for the lower hemisphere, since the construction of the Bremer lamp is such that, when used without a globe, practically all the light is thrown downwards. The distribution of light in this direction is also particularly good, being nearly uniform throughout an angle of 50° on either side of the vertical. The consumption of power in a 400-watt lamp comes out at about 0·6 watt per spherical candle and 0·4 watt per hemispherical candle for the Bremer lamp with a globe, as against 1·1 and 0·65 for an ordinary lamp under similar conditions.

WE referred in these columns a short time ago to the fact that an American company had been formed to work a process for the fixation of atmospheric nitrogen. Some further particulars of the apparatus used by the inventors, Messrs. Bradley and Lovejoy, are given in the *Electrical World and Engineer* (N.Y.) for August 2 last. A cylindrical metal box is provided on its inner surface with six upright rows of fixed contacts, there being twenty-three contacts in each row. Each contact is connected through an inductance to the positive pole of a dynamo generating direct current at a pressure of 10,000 volts. A similar set of contacts is mounted on an inner rotating cylinder connected to the negative pole of the generator. As the inner cylinder rotates, the negative contacts come up to the positive and an arc strikes across; this is gradually drawn out and finally extinguished as the negative contact moves past, and away from, the positive. The action may be likened to the rotation of the cylinder in a musical box. Air circulates amongst the arcs, and is drawn off containing about 2½ per cent.

of oxides of nitrogen and led to absorbing towers. The air is circulated at the rate of about 5 cubic feet per contact per hour, and the inner cylinder rotates at the rate of 500 revolutions per minute, thus forming more than 400,000 arcs per minute. Sufficient data are not given to enable a calculation of the efficiency of the arrangement to be made. It will be remembered, however, that the result of Lord Rayleigh's experiment showed that, given cheap power, nitrates could be made by this process at less than the present cost.

THE geology of western Rajputana forms the subject of an essay by Mr. Tom D. La Touche (*Mem.* Geol. Survey India, vol. xxxv. pt. i. 1902). The country is for the most part a vast sandy plain diversified only by sand hills and by isolated knolls and groups of hills composed almost wholly of crystalline rocks. Except when rain is falling, no running water is to be seen, and the principal agents of erosion are the intense heat of the sun, or rather the great alternations of temperature that act on the superficial layers of rock, and the violent winds aided by the sand they bear with them. Deflation, or the action of sand-laden wind, is illustrated in many curious features, notably in certain scarped outliers of horizontal beds of sandstone which appear like pyramids in the plain. Some of these known as *zeugen* or "witnesses" are figured. The crystalline rocks exposed comprise schists and quartzite, granites, rhyolites and basic dykes. The sedimentary rocks include the Vindhyan, Talchir boulder-beds, Cretaceous (?) Sandstone, Nummulitic Limestone, and recent accumulations.

IN a recent issue of the *Journal* of the Asiatic Society of Bengal, Major J. Manners-Smith records the existence of hybrids between the common wolf and domesticated dogs in the Gilgit district.

IN the October number of the *Entomologist's Monthly Magazine*, Mr. Charles Rothschild describes two new British species of fleas, the one infesting the moorhen and the other various small mammals.

MR. W. L. DISTANT, in a recent issue of the *Annals* of the South African Museum (vol. ii. pt. ix. art. xii.), publishes a series of notes on the bugs of the country, with descriptions of new species.

IN a paper on the fishes of Mexico, published by the Field Columbian Museum (zool. series, vol. iii. No. 6), Mr. S. E. Meek figures a female of a viviparous species of Goodea in which the ovary is absolutely crammed with young.

A RECENT supplement to the *Tropical Agriculturist* (Colombo) contains the text of a preliminary report by Prof. Herdman, F.R.S., on the pearl fisheries of Ceylon. The report may, we understand, be seen by those interested at the Commercial Intelligence Branch of the Board of Trade, 50 Parliament Street, S.W.

IN the *Proceedings* of the U.S. Museum, Messrs. Jordan and Fowler continue their survey of the fishes of Japan, the latest fasciculus dealing with the trigger-fishes, file-fishes and trunk-fishes. Excellent figures are given of some of these strange fishes, one of which is made the type of a new species and genus.

THE effect of wind on the migration of birds, as exemplified by the case of hawks, forms the subject of an interesting article by Mr. C. C. Trowbridge in the September issue of the *American Naturalist*. It is inferred that the migratory movements of hawks are very largely affected by wind, an adverse wind retarding, if not completely arresting them. Several other conditions of the atmosphere which affect the migration are mentioned by the author.

IN the October number of the *Journal of Conchology*, Mr. R. Welch describes and figures a number of "sports" of the common black-lipped snail (*Helix nemoralis*), showing the spiral more or less elongated above the normal. It appears that enormous numbers of these snails are collected by the peasant women in a certain district of Donegal for the purpose of making necklaces of the shells. Among this number a small percentage of reversed specimens and others with abnormally tall spires are met with and picked out for special sale. In one of the figured specimens the spiral is so elongated as to recall a Scalaria.

IN the August issue of the *Biological Bulletin*, Mr. H. F. Perkins describes a remarkable degeneration-process observed in larval cœlenterates of the genus Gonionema. After mentioning the manner in which the larvæ disintegrate, the author observes that "the repeated fission of the individuals resulted in such diminution of the size of the pieces which came from the original individuals that after a time it was impossible to distinguish the bits of living matter from the other particles lying about on the bottom. But during the entire time in which it was possible to recognise the pieces of disintegrating larvæ, the sum total of this substance did not seem to be at all diminishing. It is impossible to assign any satisfactory explanation to the phenomena, but it is not unlikely that the condition of the water in this particular aquarium was peculiar."

THE affinities of that remarkable group of worm-like creatures known as Solenogastræ and their relationship to the Mollusca form the subject of a long article by Herr J. Thiele in the *Zeitschrift fur wissenschaftliche Zoologie* (vol. lxxii. pts. ii. and iii). There are two families of these organisms, the one typified by Neomenia and the other by Chætoderma. Very generally the group is classed among the molluscs with the chitons; the author is, however, of opinion that the Solenogastræ are really worms allied to the thread-worms (as represented by the Gordiidæ) and annelids, but, in the relation of the heart to the uterus, as well as in the possession of a rudimentary tongue, or radula, approximating to the molluscs, and more especially to the chitons. If this view be correct, the Mollusca are descended from worms, the chitons representing the transitional type.

As the result of a considerable number of experiments, Dr. Margaret C. Ferguson finds that the most effectual plan for starting the germination of spores of *Agaricus campestris* is to include in the culture either some of the mycelium of this plant or else some spores which have already been induced to germinate. An account of the various methods devised to bring about the germination of spores of this and various basidiomycetous fungi is published as a *Bulletin* of the U.S.A. Department of Agriculture. An extremely useful historical summary of similar experiments is given at the end of the paper.

THE latest parts of Engler's "Botanisches Jahrbuch" contain a monograph of the Berberidaceæ and Podophyllaceæ, in which the writer, Dr. G. Tischler, proposes a separate order for Podophyllum and Diphylleia. Herr Baeyer finds that a comparative study of certain of the Anonaceæ bears out the latest division of that order by Engler and Diels into two suborders only, the Uvarioideæ and the Eupomatioideæ. An article, "Der Wind als pflanzengeographischer Factor," by Dr. Warming, is mainly a polemic against Prof. Hansen's book dealing with the East Friesian Islands. Another proposal to deal with the present confused terminology of phytogeography originates from America, and a system of nomenclature is suggested by Mr. F. E. Clements, of Nebraska.

MATTHEW ARNOLD'S well-known work on "Literature and Dogma," which, as its subtitle explains, is "An Essay towards a better Apprehension of the Bible,' has been issued for the

Rationalist Press Association, Ltd., in paper covers at sixpence, by Messrs. Watts and Co.

A NEW medical and scientific circulating library has been opened by Mr. T. H. Prince, who was for many years with Mr. H. K. Lewis, and has just started as a medical and scientific bookseller at Praed Street, Paddington. It is promised that all standard works in the various branches of science will be available to subscribers.

WE have received the concluding part of the *Boletim Mensal* of the Observatory of Rio de Janeiro for the year 1901. In addition to the meteorological observations taken eight times daily at that observatory, the *Bulletin* contains monthly and yearly results for various parts of Brazil, and a valuable summary for twenty years (ending March, 1901) for Bahia, from observations made by Dr. Guimarães.

SEVERAL new forms of apparatus for the physical laboratory have lately been produced by Messrs. W. G. Pye and Co., Cambridge. Among the instruments are a table cathetometer and a reading microscope, constructed on the geometric slide principle, an improved pattern storage cell, five hundred of which have been in use at the Cavendish Laboratory for several months and have proved "very convenient and thoroughly satisfactory," and sets of patent resistance coils, in which the coils themselves take the place of the usual plugs and can be easily removed to show the wire and method of construction.

A NOTEWORTHY paper on the decomposition of urea is contributed by Mr. C. E. Fawsitt to the fifth number of the *Zeitschrift für physikalische Chemie*, vol. xli. When a pure aqueous solution of urea is heated at 100° C. for a considerable time, the urea is completely transformed into ammonium carbonate. This decomposition takes place also under the influence or acids and bases, the velocity under these circumstances being much greater. If strongly alkaline solutions are excepted, the decomposition takes place in all cases according to the simple equation for a unimolecular reaction, a result which does not accord with the ordinary method of representing the reaction. The author finds that the facts can only be satisfactorily explained by assuming that the urea is in the first place transformed into ammonium cyanate and that a state of equilibrium is set up between these two substances. The cyanate, however, is gradually decomposed with the formation of ammonium carbonate, the equilibrium being thus disturbed, and a further quantity of urea undergoes transformation into the cyanate. This decomposition of ammonium cyanate into ammonium carbonate takes place very quickly under the influence of acids. A large amount of experimental evidence is found to support the theory advanced, and the author concludes that urea is not directly attacked either by water, acids or moderately concentrated alkalis. Concentrated solutions of the alkalis have probably however a direct saponifying action upon the urea, in addition to the indirect action described.

AN investigation of the rate of bromination of carbon compounds by L. Bruner, which will be of considerable interest to organic chemists, is published in the current number of the *Zeitschrift für physikalische Chemie*. The catalytic action of iodine on the bromination of benzene has been carefully studied in a quantitative manner, and it is shown that this action is very probably due to the formation of iodine monobromide, which by its dissociation gives rise to free bromine atoms. These free bromine atoms are the active agents in the bromination process, and the catalytic influence of the iodine is due to the much greater dissociation of the iodine bromide as compared with that of bromine itself. The author shows that the substitution of bromine is a quadrimolecular reaction taking place according to the equation

$$C_6H_6 + 4Br = C_6H_5Br + HBr_3 \rightleftarrows Br_2.$$

The action of other carriers has also been investigated, the most active in the case of the bromination of benzene and bromobenzene being aluminium bromide. This compound has, however, no influence on the bromination of nitrobenzene. From the concentrated nitrobenzene solution, a compound of the formula $AlBr_3.2C_6H_5NO_2$ has been crystallised out, a fact of some interest in view of Gustavson's theory of the mode of action of $AlBr_3$ in the bromination of benzene, toluene and other compounds. The author has finally investigated the relative velocities of some so-called instantaneous reactions. It is found that the bromination of aniline takes place more rapidly than that of phenol, and that the velocity of the latter reaction is about one-fifth of that at which iodine is separated by bromine from potassium iodide solution.

THE additions to the Zoological Society's Gardens during the past week include a Vervet Monkey (*Cercopithecus lalandii*) from South Africa, presented by Mrs. Chas. Lisle Hacket; two Mozambique Monkeys (*Cercopithecus pygerythrus*) from East Africa, presented respectively by Mr. J. M. Creasey and Mrs. G. Ord; a Common Marmoset (*Hapale jacchus*) from South-east Brazil, presented by Mrs. Murray Simpson; a Gannet (*Sula bassana*) from Scotland, presented by Lord Ribblesdale; six Carolina Anolis (*Anolis carolinensis*) from Florida, two Tarantula Spiders, from Arizona, presented by Miss Ilda Orme; two Entellus Monkeys (*Semnopithecus entellus*), two Sambur Deer (*Cervus aristotelis*), two Nylghaies (*Boselaphus tragocamelus*), two Tigers (*Felis tigris*), two Gadwells (*Chaulelasmus streperus*), an Indian Adjutant (*Leptoptilus argala*) from India, two Nutmeg Fruit Pigeons (*Myristicivora bicolor*) from Moluccas, received in exchange; eight Saddle-backed Tortoises (*Testudo ephippium*), two Thin-shelled Tortoises (*Testudo microphys*), twenty-four South Albemarle Tortoises (*Testudo vicina*), one —— Tortoise (*Testudo* ——), seven —— Iguanas (*Conolophus subcristatus*) from the Galapagos, four Indian Porphyrios (*Porphyrio calvus*) from Eastern Asia, a Brindled Gnu (*Connochaetes taurina*) from South Africa, deposited.

OUR ASTRONOMICAL COLUMN.

A NEW TRANSITING DEVICE.—An article by Mr. M. B. Snyder, of the Philadelphia Observatory, in *Popular Astronomy*, No. 97, discusses a new device for transiting stars, in which the micrometer thread is moved, with a regular speed, across the field by means of an electric motor.

The fundamental idea of getting rid of the personal equation in transit observations by using mechanical transiters was first suggested by Braun in 1865 and since then has been persistently developed by Repsold. After discussing the various methods suggested by these and other inventors, Mr. Snyder gives some details of his own device, although full details are withheld for a future communication when circumstances have permitted of more time being spent on the subject.

In Mr. Snyder's instrument, the micrometer screw, and thereby the micrometer thread, is driven across the field of the instrument by an electric motor, at a speed depending on the declination of the object observed, whilst at the same time the observer, by using a secondary adjustment, keeps the star image accurately bisected, and the various positions of the thread are automatically recorded, by means of an ordinary chronograph, at the end of each revolution of the screw. Then at the moment of meridian passage an automatic electrical arrangement records the instant of transit. The micrometer in its fundamentals is of the ordinary type, and is at present attached to the 4-inch meridian circle of the Philadelphia Observatory; it is so arranged that, with the motor driving regularly, visual observations may be made, and recorded by any one of the usual methods, synchronously, thus forming a ready means of determining the personal equations existing between the various individuals of any group of observers.